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Critical Complexity: A Challenge to Engage for Educators

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ABSTRACT

Education is a means of ensuring the survival of the human race. By passing on knowledge and awareness, humans attempt to craft adaptability of future generations. Adaptability allows humans to respond to unforeseen events that may challenge their survival.

Education is a process that works to achieve change and growth of the individual and the regeneration and transformation of society. The outcomes of interactions in educational systems are uncertain and emergent. Educational systems are open, adaptive, complex, dynamic and non-linear.

In the near past, reducing the complexity of natural and social phenomena has allowed the human race to simplify and understand many complex ideas in physical and social science. Oversimplification has begun to limit the full comprehension of the elements that are complexly related and interacting in the natural world. The limits imposed by reductionist mindsets are not allowing for adaptability of the human race to a newly emerging, complex, interconnected age that does not resemble any previous existence of humanity.

In order to escape the limits of reductionism, complex thought must be re-introduced in education. Educators must think complexly and appreciate and embrace complexity and uncertainty. They must engage in critical complexity by fostering new states of mind and by collectively creating frameworks for addressing challenges that will appear recursively.

ERIC DESCRIPTORS

Role of Education

Educational Change

Educational Philosophy

Intellectual Freedom

Professional Autonomy

Teacher Empowerment

Politics of Education

Systems Development

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DEDICATION

> *It is the political task of the social scientist — as of any liberal educator — continually to translate personal troubles into public issues, and public issues into the terms of their human meaning for a variety of individuals. It is his task to display in his work — and, as an educator, in his life as well — this kind of sociological imagination. And it is his purpose to cultivate such habits of mind among the men and women who are publicly exposed to him. To secure these ends is to secure reason and individuality, and to make these the predominant values of a democratic society.* - C. Wright Mills, The Sociological Imagination, 1959.

In my work as an educator and social scientist I have encountered troubles that have become highly personalized. I submit this paper as part of my reflection on the oversimplification of education, and as a challenge to all educators to engage in complex thought and critical complexity. I invite you to reflection, to inquiry, and to appreciate the complexity of the world and of this profession. I ask you to join me in the realm of complexity and to engage in our profession creatively and humanely. Let us be individuals. Let us be educators. Let us be social scientists and future makers.

What is complex thought?

Complex thought is a state of mind and a way of thinking developed by Edgar Morin. In a lifetime of work, Edgar Morin, a French philosopher and scholar, influenced and informed discussions on the paradigms of simplicity, complexity, and reductionism. In his work, Morin asserted that ways of thinking traced historically to the Enlightenment worked towards simplification of complex phenomena. The simplification of these phenomena occurred through a reduction of their complexity. By breaking these naturally-occurring social and environmental phenomena into smaller parts, philosophers and scientists have been able to reduce their complexity in order to observe and analyze them in greater detail. However, by breaking complex phenomena into such simplistic parts, their wholeness was destroyed (Morin 2008).

Complexity reduction can be understood as the breaking into pieces of any phenomenon in order to understand its parts. While such a simplification can be justified to some extent and can even be deemed necessary, the inability to piece together the parts in order to see the whole is not conducive to a holistic appreciation of reality. Morin critiqued the way "knowledge" is conceived, and questioned the valorization of simplicity through reductionism, which ultimately hides the complexity of all things (Morin 2008).

Rogers et al. provide an excellent description of reductionism in an article called "Fostering Complexity Thinking in Action Research for Change in Social-Ecological Systems":

> *The reductionist mindset seeks to understand the world as a collection of separable and thus independent units and assumes linear cause-and-effect relationships between these units and that these relationships are reversible. A system and its parts, are therefore, assumed to have an ultimately knowable structure and behavior (Rogers et al., 2013, p. 3).*

This mindset provides an escape from the uncertain world into an illusion of order and control. It has framed a non-complex reality for most members of western society, and has led to distaste for complexity and chaos, and ultimately to binary, dichotomous ways of thinking (Morin, 2008).

Edgar Morin posited reductionism as a force of destruction to the complex world and to the human ability to understand and live complexly in it. He challenged philosophers, scientists, scholars and educators to consider complexity and transform their ways of thinking to re-embrace complexity. He argued that, "We need a kind of thinking that reconnects that which is disjointed and compartmentalized, that respects diversity as it recognizes unity, and that tries to discern interdependencies. We need a radical thinking (which gets to the root of problems), a multidimensional thinking, and an organizational or systemic thinking" (Morin, 2008, p.vii). The goal of embracing complex thought is to be aware of the possibilities and consequences of complex thought and complexity reduction.

Complex thought embraces what is part and whole, what is one and part of many. It seeks to frame "knowledge" as ultimately subjective; a thing that is experienced by one person through the lens of individual experiences and circumstances. Further, complex thought is situationally and temporally bound. The interplay of time and place on ideas and people collectively and individually is not to be ignored. Thus, absolutes are always questionable. Ultimately, certainty is only a guise for the inability of people to balance their reality in an appreciation of uncertainty (Morin 2008).

Again Rogers et al. provide an excellent frame of reference for complexity:

> *Under the complexity paradigm, variability and uncertainty are valued givens, so complexity thinkers seek to understand systems in terms of the heterogeneity of their structure, relationships, and properties that emerge from interactions.*
>
> *The many variable elements interact dynamically in a causal thicket (Wimsatt 1994) and interactions are propagated throughout the system in nonlinear ways. The behavior of a system is determined by the nature of interactions, not the character of the components, and so relationships are fundamental. Temporal (history) and spatial contexts codetermine interaction outcomes, so two similar-looking systems with different histories, or in different places, are not the same. There are many direct and indirect feedback loops, so the scale of the effect is not related to the scale of the cause, and behavior cannot be predicted from knowing the components. Complex systems are not ultimately knowable in space or time (Cilliers 2000), and thus scientific objectivity becomes largely a myth and not necessarily desirable, let alone sacrosanct (Rogers et al., 2013, p.3).*

Value is given here to uncertainty, heterogeneity, and the emergence of new behaviors and properties/structures following the interactions and relationships of a variety of interplaying entities. It is a challenge to consider and embrace what appears to be chaotic when one has been educated to believe in order and control. This is the challenge of complex thought, and it has impacted many fields in academic discourse and research (Morin 2008).

This is also the challenge of this paper as it seeks to frame education for educators, proposing a depth of comprehension into the nature of its interactions, and a challenge to critically engage in the complexity of the profession. Complex thought is a necessary state of mind for educators to engage in critical complexity.

Morin's contributions to complexity theory are central to this paper and to education because of his role as a post-modernist, post-structuralist philosopher. "La Pensée Complexe" or complex thought is fundamentally important as a way of thinking that allows scholars to work on developing deeper understandings for collective knowledge about complex phenomenon.

Many scholars have worked on embracing a more complex view of reality and have criticized practices that reduce the understanding of complex phenomena. Complexity theory and anti-reductionism is and has been the work of many scholars in a variety of disciplines. Diane Larsen-Freeman explains that, "It is difficult to trace the origin of Complexity Theory to a single source; it has many antecedents" (Larsen-Freeman, 2017, p. 12). She goes on to explain that complexity theory has seen contributions from the physical sciences, moved into social sciences, and has roots in philosophy, both ancient and modern (Larsen-Freeman, 2017, p. 12-13).

Transdisciplinary theory or transdisciplinarity is an important movement forward in the work of complexity theory scholars. This movement seeks to unify the work of all scholars and challenges the division of academia into disciplines that do not share and build on one another. Larsen-Freeman promotes transdisciplinarity as she clarifies its relationship to complexity theory:

> *CT is transdisciplinary in two senses of the term. First, "Complexity theory represents an important challenge to the disciplinary silos of the twentieth-first-century academy" (Byrne & Callaghan, 2014, p. 3). Second, besides transcending disciplines, it introduces new cross-cutting intellectual themes of the same magnitude and import as other such themes from the past, e.g., structuralism and evolution (Halliday & Burns, 2006) (Larsen-Freeman, 2017, p. 15).*

Thus, complexity theory, transdisciplinarity and complex thought have much to contribute to education now and in the near future.

Educators as guardians of knowledge can benefit from the work of Edgar Morin and other Complexity Theory scholars in several ways. First of all, complex thought is beneficial for understanding and being in the world. Second, complex thought and complexity theory provide new outlooks and frameworks for the structuring of education and knowledge. Additionally, the influence of complex thought and complexity theory allows educators to drive progress, growth, and change, which is the essential purpose of education.

What is critical complexity?

Paul Cilliers coined the term "critical complexity". He wrote that it is "an acknowledgement of our limitations" (Cillers 2000, p.viii). He proposed that:

> *Critical complexity can employ all the ideas and tools from a wide array of approaches to complexity but in a reflexive way. Our methods, tools and models have to be revised continuously, without the assumption that we will somehow converge on a final solution. There is hardly a field in which this acknowledgement is more urgent than in education" (Cillers 2000, p.viii).*

The impetus to this paper is in this quote. How does one engage in critical complexity in education? One must acknowledge the urgency to engage; consider power dynamics and competing discourses in education through differing values and ethics; and finally frame the engagement in an awareness that solutions are provisional, limited, and value driven, and challenges are recursive (Rogers et al. 2013). Thus, educators must prepare to be challenged again and again, and learn how to respond in a complex and critical way. Educators are also charged with preparing a new generation with the knowledge, skills, and awareness to respond to the new, emerging challenges of the future that are uncertain and unknown.

This paper does not seek to provide solutions. It seeks to challenge educators to openness, new mindsets of complex thought, and to connect with one another to create frameworks and communities for engaging in critical complexity. The questions that begin each of the sections in the paper are posed as a way of framing the nature of education. They are also a beginning of a type of discourse that educators may choose to engage with in response to the challenges of education in a new age.

What is education?

The simplest of questions often prove the most difficult to define in depth without philosophical exploration. “What is education?” is a question that is deeply philosophical and existential. When asking this simple question what are we seeking to clarify? Who participates in education? For what purpose? By what means? In which physical space and at which times? Who are the experts in education who can answer these questions? If one was to ask a practicing doctor the question, “What is medicine?” one would expect an answer that frames and justifies faith in the profession and the practice. Similarly one would expect an attorney to believe in and be able to fully explain the nature and necessity of law. Do the same expectations hold up for educators and teachers who practice education as a profession? Are educators able to answer this existential, philosophical question concerned with the nature of their profession?

Education is society’s response to the need for growth, for change, for stability in the short term and flexibility in the long term. A former MAT TESOL student, William Culver quoted John Dewey in his thesis as saying, “Education is growth. Education is not a preparation for life; education is life itself” (Culver, 2012, p. 2). Education is the way in which humans respond to their environment by reacting to the stimuli that life presents. This happens at an individual level as a person becomes educated by others and by life. This also happens at a societal level, as education is made into a social construct that is bound in place and time by rules of engagement, with specific socio-cultural and historical significances and frameworks, with parties that engage in a specific definition and purpose of education (Biesta 2000). Whether singular or collective, education is life, only if education allows for transformation, regeneration, and growth.

We have a justification for the engagement with the question, "What is education?" when we view the relationship between life and education existentially. If life is an "active resistance of death… a striving to build and perpetuate a self-distinct physical unity… which is committed to maintaining its independence from the equalizing forces of the non-living world" (Osberg, 2000. p.159), then life must revolve around learning how to resist death and how to teach the next generation to resist death. In one way, life is dependent on education. Without education humanity would not be able to grow or thrive. It would succumb to the "equalizing forces of the non-living world" (Osberg, 2000. p.159). Thus, education is one human response to long term survival.

In the book, *Education: A Very Short Introduction*, by Gary Thomas, the author elaborates on the nature of education.

> *The progress trajectory of Homo Sapiens veers upward ever more steeply not just because of our cleverness but because of the ability of our species to crystallize and store knowledge in specialized sounds and languages, and then play with it – build and forge and mould it and model with it - using it to grip hold of the past and to imagine and plan the future. But the really clever bit is that we can share it and build on it; we can pass all of this on to our offspring, friends, and colleagues. Out of our cleverness has emerged something almost more important than the cleverness itself. Out of it has come learning about how to share ideas and pass down skills and knowledge. Out of it has come education (Thomas, 2013, p.1-2).*

Education has emerged from our species' ability to communicate, to teach and learn from one another. It is one of our abilities to continue as a species. We have learned to use language to grasp the differences between past, present, and future in order to adapt to the uncertain. We have used language and education as a means for survival and for growth.

This growth is the etymological root of the word education. There are two Latin root words for education: *educare* meaning to bring up, to rise, to nourish or to train and to mold; and *educere* meaning to lead out, to draw out, to bring from. Much debate has gone into the

difference between these terms, the nature of education, and the dichotomy between bringing out what is naturally occurring versus the training of behavior. This is a perfect example of the binary nature of reductionism and the conflict that it promotes. In a reductionist mindset, education must be either *educare* or *educere*, but not simultaneously both. In their article, *Educare and Educere: Is a Balance Possible in the Educational System?*, R. Bass and J.W. Good identify the debate, the dichotomy, and the challenges of education:

> *Craft (1984) noted that there are two different Latin roots of the English word "education." They are educare, which means to train or to mold, and educere, meaning to lead out. While the two meanings are quite different, they are both represented in our word "education." Thus, there is an etymological basis for many of the vociferous debates about education today. The opposing sides often use the same word to denote two very different concepts. One side uses education to mean the preservation and passing down of knowledge and the shaping of youths in the image of their parents. The other side sees education as preparing a new generation for the changes that are to come—readying them to create solutions to problems yet unknown. One calls for rote memorization and becoming good workers. The other requires questioning, thinking, and creating. To further complicate matters, some groups expect schooling to fulfill both functions, but allow only those activities promoting educare to be used (Bass, R. & Good J.W., 2004, p. 162).*

Educators who engage in critical complexity and complex thought would be able to embrace both the similarities and the differences between these two terms. Both definitions invite us to appreciate that education is a process of growth. This growth happens by using lessons from the past which are to be applied to the present, as well as allowing the unknown future and the challenges of the present to determine what growth will need to happen. As Bass & Good make clear,

> *In the overall scheme of things, educare and educere are of equal importance. Education that ignores educare dooms its students to starting over each generation. Omitting educere produces citizens who are incapable of solving new problems. Thus, any system of education that supplies its students with only one of these has failed miserably* (Bass, R. & Good, J.W., 2004, p. 164).

Complex thought invites thinkers to resist the need to oversimplify. In a mindset of complexity appreciation, one can view education as both an intentional and unintentional process with unknown and uncertain outcomes. In a mindset of critical complexity, one can further delve into

the understanding that education is an existential response to human survival; it is growth for the individual and for the society; and it is a response to the need for stability in the present and adaptability to the future. As such it is only one thing, but it is also everything. It cannot simply be left to chance.

Educators must have a deep understanding of the nature of education in order to respond to the question, "What is education?" There must be a complex understanding of the nature of education in the past and present and a consideration for the possibilities of the future. Educators must also understand the nature of their engagement in their profession as well as their role in ensuring that education is successful. One way for educators to assist in the success of education is a balance of educational philosophies and "establishing a shared vision of education" (Bass, R. & Good J.W., 2004, p. 168).

Where is education in the past, present, & future?

Decades of technological advancement have changed the human experience for the global population. The human experience is different today than it ever was before. It is more interconnected. Today the human population experiences fewer boundaries, but also shares more with other humans. Many phenomena including language, technology, and limited resources have tied us together in ways that were never before expected. Montuori and Donnelly address this change in their article entitled, "The Promise of Integrative Transdisciplinarity":

> *Global society is in a transitional time, a "postnormal" era: we live in an interregnum between one dying world, variously known as modernity or the Industrial Age, and an emerging age whose outlines are not yet clear. Ours is an era marked by chaos, contradictions, and complexity (Sardar 2010, 2015) (Montuori & Donnelly, 2016, p. 744).*

As this age continues to emerge, new challenges arise in educating humans to be equipped with the awareness, knowledge, and skills they will need to survive. Reactions to these challenges have also emerged and can be seen in a variety of proposed solutions, frameworks, and ways of considering education and learning. Educators are aware of how quickly solutions, frameworks, and mindsets change in response to newly perceived challenges to life. This process has been particularly chaotic in the last decades as this *interregnum* has shown itself, and it will continue to be chaotic through the move into an uncertain age characterized by interconnectedness and complexity.

Through the chaotic transition, the discomfort felt leads to an increased desire to control education, reduce its complexity, and regulate "schooling". This is well summarized by Alfonso Montuori in his foreword to the book, *On Complexity*, by Edgar Morin:

> *In times of transition, complexity, uncertainty, or faced with potential or even actual chaos, there is a tendency to seek out absolute foundations, certainty, simplicity, and a*

> *framework that will make sense of the world and reduce our anxiety (Morin, 2008, p. xxxvii).*

This tendency to control and simplify is taken on by policy makers that seek to limit the power and autonomy of teachers. They question both the nature of education and the good judgement of teachers implicitly through over-regulation and explicitly through the political discourse surrounding education. Biesta and Osberg approach this subject in the introduction to their book on complexity, education, and politics:

> *One discourse surrounding education is that of "control", and many policy makers and politicians continue to express a desire for making education into a perfectly controllable and perfectly predictable technology… the fact that many educational practices and processes are not able to achieve a perfect match between "input" and "output" is seen as a problem that needs to be overcome (Biesta & Osberg 2000, p. 1-2).*

The response to the attempt to control education (through the lens of complex thought) is simple – education cannot be controlled because its outcomes are inherently uncertain and emergent. The only metric of success of education is seen retrospectively through the ability of future generations to adapt to unforeseen challenges. Thus, attempting to control education and make it a perfectly functioning machine with preset input and output is naïve and counterproductive.

Complexity theorists have "questioned the appropriateness of the machine metaphor" not only as it relates to education, but as it relates to "the social and the natural world" (Biesta & Osberg 2000, p. 2). Complex thought and thinkers who embrace complexity have moved past the need to create deterministic realities of the world and instead embrace the emergent nature of the future that is being created through the daily interactions of the present. Each day's responses to new stimuli craft and create the future that emerges in an unpredictable way.

Complex thought does not create binaries of right and wrong, between embracing complexity and reducing complexity. Thus:

> *...complexity's emphasis on non-linearity, unpredictability and recursivity is not meant as an argument against or a denial of order. It should instead be understood as a case to see order differently… as something that emerges in genuinely generative ways (Biesta & Osberg 2000, p. 2).*

Complex thought would assert that the desire to increase control and thereby attempt to achieve equilibrium in the input of information by teachers and the output of knowledge and awareness of students will not guarantee the success of humanity in this new and emerging age with any certainty. Nor would complex thought assert that chaos is the order of the day. Instead, complex thought embraces uncertainty and complex thinkers cannot propose solutions that "fix" complex problems.

It is important to reflect again on our current way of thinking in reference to educational systems. Educational systems are not closed systems as perceived by the machine metaphor. They are systems that are open, complex, adaptive, dynamic, non-linear, and emergent. Openness implies receiving influence from outside the system and using it to create new levels of order that emerge over time. Complexity implies that a system's components are interconnected and dependent on the time and place of their context. Adaptive implies that a system will change in response to changes in its environment. Dynamic means that a system is always undergoing change even at times when it appears relatively static. Non-linear implies that every interaction within the system and its components is creating causations for the future that are unpredictable and irreversible. The causations lead to emergence, or the "spontaneous occurrence of something new" (Larssen Freeman, 2017, p. 15-17). Complex thought invites educators to perceive the system of education in a new and challenging way. No longer can the

machine metaphor of a closed system with preset input and predictable output be upheld. Educators need to understand the complexity of open, adaptive systems and use this understanding to drive their vision and philosophy as well as their research and practice.

On complex thought, Alfredo Montuori writes:

> *Complex thought leads us to a way of thinking – and being in the world – that recognizes the inescapable dimension of uncertainty, and views it as an opportunity for creativity and the development of new perspectives, rather than primarily a source of anxiety (Morin, 2008, p.xxviii).*

Rather than using reductionist mindsets from the past to control the present in the belief that the future can be controlled, educators must understand that the future is created in an emergent way through the educational interactions of the present. We, as educators, must embrace present opportunities for creativity and the awareness that success will only be retroactively perceived in the future to the actions of the past and present. We must also move into mindsets of awareness and acceptance of complexity and the complex systems that we participate and live in.

Who participates in education?

Arguably the entire global population participates in education when we define it as the human response to long term survival and the desire to explore new things (Reagan 2018). There are not two completely identical humans on earth having the exact same experience. Each human is engaging in education in some way to gain and to pass on knowledge and awareness for their own survival and for the benefit and growth of their community. Each individual is in essence tied to a community, virtual or real, because it made and makes them (part/individual) and because they are what make it (whole/community).

Edgar Morin has expounded on the nature of our engagement with ourselves and with others in his work on what is part and whole, singular and collective. Each of us in our own individual interactions with life and with others is at once both one and (part of) many. Neither the part nor the whole is more important than the other. They are complexly related. The whole must serve the needs of the part and the part must work to make the whole function. A. Montuori cites the writing of Morin on this subject: "He focuses for instance on the way individuals are in society but society is also in individuals, and the way human beings create culture that in turn creates human beings" (Montuori, 2013, p. 15).

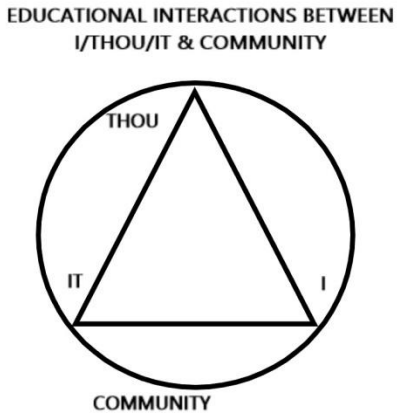
This dynamic applies to education as well. Each individual is a part of the society in which they live, and the way that they are educated prepares them to be qualified through skills and knowledge, socialized into a particular class, region, and culture, and subjectified to become unique individuals (Biesta 2015). Recursively, individuals then take that which education bestows upon them or subjects them to and they give it back to the whole of society. Complex thought invites us to consider that these interactions (education) are responsible for both the positive and negative consequences of this feedback loop. This is not an idea which should cause

fear, but rather one that should invite reflection and deep appreciation for the processes involved in creating individuals and society (Biesta 2015).

Hawkin's I/thou/it triangle can be used as a useful framework to better understand the entities that participate in education (Hawkins, 1974). A teacher/educator (I) interacts with a student/learner (thou) to pursue understanding, mastery, and the evolution of a certain content area (it). The triangular nature of this framing challenges the surveyor to seek a perspective within the three entities involved in educational interactions. Each point of the triangle is an evolving and ever changing entity. "I" as teacher cannot interact with "thou" as learner without the third part of the "it" to make an educational interaction. Likewise, "I" as learner need "thou" as teacher to seek mastery of "it" as content. The necessity of each entity in the triangle of educational interaction shows the evolution of humanity from one generation to another. It also shows the evolution of ideas from teacher to learner and from learner to teacher, and encourages movement and progress. As teacher and learner interact with the content, the "it" changes. It grows. It is passed on and added to. It becomes more than just the understanding of the two individuals engaged in communication as it is shared with the larger community.

The interactions within the I/thou/it triangle and with the larger community that encircles the practicing of education create the system through which education is defined. Education is socially constructed to create a system with a specific group of people following certain rules regarding educational practice and interactions. Educational systems are open systems. Within different communities the social construct of educational systems varies. There are different rules, different encouraged interactions, and different outcomes (Reagan 2018). This is part of the nature of the openness of a complex, adaptive system. Theoretically, the characteristics of an

open, complex, adaptive system, as defined by the specific rules, interactions, and desired outcomes of the system, exist to serve the interests of the community it exists in and its values.



Interestingly, "two similar looking systems with different histories, or in different places, are not the same" (Rogers et al., 2013, p.3). This can be true for systems operating at the same time in similar but different places. It can also be true for systems operating at completely different times and/or in different places around the world. As time changes the reality in which certain communities exist, there are also changes regarding who/what engages in education.

While educational systems are often perceived as closed systems they are in fact open and adaptive. Societies that have created closed systems of education that operate under heavy regulation and absolutism will eventually become open, adaptive systems when introduced or experienced by people in different times and places. Educational systems must be adaptive and open because of the challenges that are posed by educational interactions in time and/or place. Thus, some have argued that the role of teacher will soon become obsolete as technology replaces the human involved in this educational interaction. This possibility represents the adaptive nature of education as outside influences (technology in this example) change it over time.

Even though one part of the same country may have a similar system to another, if they have different histories, and are in different places, then they are not the same. This idea is key in understanding why educational interactions must be contextualized. Teachers and others involved in the education process must arrive at "situational awareness", a term defined by Rogers et al. in their work on complexity thinking. "Situational awareness" is a framework with specific habits of mind that help participants to think complexly. In complex systems, "spatial and historical context are very important, but so too are the different participants' value systems and how they lead to different outcomes" (Rogers et al., 2013, p.7). Reflecting on this idea means that teachers in different schools engaging in education all over the country justifiably will be having different interactions. Once again, these should serve the interests of the specific community and its values. As such, attempting to regulate the interactions of all people engaged in educational interactions across time and space is antithetic to the complex nature of open adaptive systems of education.

The changes that occur in educational systems and interactions happen because of stimulus to a complex adaptive system. The process through which these changes occur is through emergentism: the interactions of the present create the reality of the future in innovative and uncertain ways. Being aware of this phenomenon will help the educator frustrated with chaos to embrace the natural adaptation of a complex adaptive system to its environment. It should also help to frame the educator's interactions, and perception of stimuli. If anything, engaging in complex thought and learning about the complex nature of educational systems should allow the educator a place of neutrality to act and to choose engagement with agency to be a positive force on the future.

What is the purpose of education?

If each educational system is only how one group of people define education in a certain place and time, then are there absolutes regarding the nature of education that hold true for every system? According to Gert Biesta, yes. He has argued that "the point of education is that students learn something, that they learn it for a reason, and that they learn it from someone" (Biesta 2015, p. 76). This perspective can be framed within Hawkin's I/thou/it triangle: something must be learned (it), for a reason (that serves the student - thou), and it must be learned in collaboration with someone (I). This someone can be represented by "a more knowledgeable other", to use a Vygotskyan term. As Biesta states, "education always needs to engage with questions of content, purpose and relationships" (Biesta 2015, p. 76).

To philosophically dig further into the question of purpose, we must consider education as being fully imbibed with and inherently needing a sense of purpose (Biesta 2015, p.77). This purpose must serve to move the individual from a state of vulnerable infancy and ignorance in which they cannot "actively resist death" to a state of stability and preparedness for change, growth, and ultimately survival (Osberg, 2000. p.159). The individual will then use their education to contribute to the whole of society, both by serving themselves and their own well-being and that of the collective. Education is inherently filled with meaning and purpose in an individual and a collective way.

It is important to note here that education is not fool-proof. This process doesn't occur simply or easily. It is full of error because it involves people. Negatively perceived interactions occur, the consequences of which are negative effects on the individual and the collective. This awareness is part of the understanding of complex thought regarding the education system. Accepting this reality does not mean that one does not believe in the positive role of education. It

means that those involved in education must assume responsibility for their role, their actions, and their interactions within education, for themselves and for the whole of the community (Biesta 2015).

Education prepares us to engage with ourselves and with others in various ways. Gert Biesta has stipulated that "in education the question of purpose is a multidimensional question because education tends to function in relation to a number of domains" (Biesta 2015, p.77). The domains he lays out are qualification, socialization and subjectification. Each of these three domains overlap in the realm of education as each individual seeks and finds meaning, reason and purpose in and through their educational interactions with others and with content (Biesta 2015, p.77-78).

QUALIFICATION

The way that most people understand the purpose of education is only the first domain of education – qualification. "Qualification has to do with the transmission and acquisition of knowledge, skills and dispositions… it allows children and young people to 'do' something – it qualifies them" (Biesta 2015, p. 77).

Over the millennia, education has taken on many forms. Most recently, education has become a system of schooling to produce generations of workers with the appropriate skills to take on the challenges of the industrial revolution and post-industrial age. In the book, *Education: A Very Short Introduction*, Gary Thomas clarifies that the current engagement with education is a remainder and a reminder of what was initially a response to the economic system of the day.

> *Schools now became instruments of the dominant economic system: capitalism. The industrial-military machine became the executive director and the school its servant.*

> *Capitalism needed workers who possessed and could use particular kinds of knowledge; schools provided them. (Thomas, pg. 13)*

While capitalism still exists, it is important to recognize the differences in the capitalist system that valued zero interaction between workers to reduce spontaneous interaction that would limit the machine like functioning of a factory, and the capitalism of today that is extremely interconnected and functions as a reflection of the spontaneous interactions between people all over the world (Morin, 2008, xxxv). The perception of the capitalist economy and schooling as closed systems is reductionist. While this reductionist mindset may have been valid and useful in the past, the present and the future do not and will not reflect economies and education as closed systems.

Education certainly must still continue to qualify the next generation to contribute specific knowledge and skills and to be able to function in their society. This is an essential part of education in the way that it prepares people for stability and adaptability, for growth and change. The challenge that educators must engage with is how to qualify their students in a way that reflects open, adaptive systems of education and economy. What qualifications can a student be given for a future that is essentially unknowable? (Gardner 2009)

SOCIALISATION

Qualification cannot be the only purpose of education as it does not do justice to the intricacy and nature of education as a means of growth & survival. Not only does education qualify people, it also socializes and subjectifies them. In many conversations on education, laypeople (those not involved in education) will acknowledge that socialisation is another domain in the purpose of education. Gert Biesta has elaborated: “Through education we also represent and initiate children and young people in traditions and ways of being and doing, such

as cultural, professional, political, religious traditions, etc. This is the socialisation dimension" (Biesta 2015, p. 77).

The best way of summing up the importance of socialisation is by looking again at this quote on the idea that "individuals are in society but society is also in individuals, and the way human beings create culture that in turn creates human beings" (Montuori, 2013, p. 15). Without socialisation, there is no humanity. People literally cannot *become* without socialisation. It is intrinsic in the human experience to be socialized into a particular culture, in a specific place and time.

SUBJECTIFICATION

Finally, education also works in the domain of subjectification, which allows individuals to know themselves and develop their character through experiences and interactions in education. Biesta writes:

> *Education also impacts positively or negatively on the student as a person. This is what I have referred to as the domain of subjectification, which has to do with the way in which children and young people come to exist as subjects of initiative and responsibility rather than as objects of the action of others (Biesta 2015, p. 77).*

By becoming a subject, a person fully aware of themself, imbibed with initiative and responsibility for their actions and interactions and by the initiative and responsibility of their educator, each person becomes able to adapt, to change, and to accept themselves and others in a given place and time. This is a complex system of human engagement, and with it comes a complex appreciation for educational interactions.

Education Domains & Interactions

The teacher must be aware that these three domains are functioning simultaneously so as not to ignore or forget about the consequences of experiences in the educational system and the ways in which they will affect each domain for the individual (Biesta 2015, p. 77). Furthermore, educators must be aware that each individual is a reflection of the complexity of the social construct of the education system. If the education system does not serve an individual, that individual in some way cannot serve the whole of their society. Thus, education is part of the system through which all parts are prepared to function within the whole as well as how each part is crafted to represent a complex whole. This is vitally important for educators to understand as they are taking part in the everyday process of creating new and unique individuals through the experiences that their students have, as well as creating the whole entirety of society both in the present and in the future.

What is knowledge?

In a recent interview for LIRE, Edgar Morin was asked if he had to preserve one book in all of his work (approximately sixty years of writing and publishing), which would it be? He responded that it would be Method, and specifically his work on Knowledge of Knowledge (Marivat & Liger, 2017, p. 49). The import of this recent statement is that in spite of all of his work on complex thought and systems theory, including work in fiction, cinema, philosophy, science and the humanities, the most important contribution that this author sees that he has given the world is the awareness that knowledge is an elusive concept and nothing is in fact reliable. Morin has written, "Does knowing that knowledge cannot be guaranteed by a foundation not mean that we have already acquired a first fundamental knowledge?" (Morin, 2008, p. vii).

The discussion on knowledge of knowledge requires extensive depth and framing of the inquiry. "The question is not just *what* we know, but *how* we know, and *how* we organize our knowledge" (Morin, 2008, p. xxvi). What do we know? How do we know it? How do we agree to give it value and consider it knowledge? Then, how do we value it in respect to other things that we know? If we (humanity) are going to determine what we value, then what processes must we go through in order to qualify, organize, transfer and advance knowledge?

The debate and discussion of these questions is extensive. Perhaps this is why Morin saw it as the essential and existential question that required further inquiry into the engagement of education. In response to these questions much has been written and suggested, including the framing of problems such as fragmented intelligence due to hyper specialization in education/academia, as well as the proposed provisional solution of integrated transdisciplinarity as a response to how knowledge is organized (Morin 2008, Montuori & Donnelly 2016). Another

example is the Douglas Fir Group Manifesto. Rogers et al. have also proposed frameworks for working through complex thought in action research, and contend that, "we grossly underestimate the true effort required for knowledge transfer and thus learning" (Rogers et al., 2013, p. 4).

In educational interactions, this awareness is of utmost importance in the communication between *thou* and *I* about *it* for the purpose of qualifying, socializing, and subjectifying the student for the benefit of the individual and for the collective. What is knowledge? What is learning? What can be passed on as "knowledge" without first passing on an awareness of the nature of "knowledge"?

Furthermore, what can one ever know that one has not experienced? How can two people experience the same thing, and yet not have the same knowledge? Subjectivity and individual experience are paramount. Montuori justifies this position in the following statement: "An awareness of our "lenses", our own biases and interests and the often implicit matrices with which we construct our knowing, is an essential dimension of Complex Thought, our own knowledge of knowledge" (Montuori, 2013, p. 12). Rogers et al deepen the understanding that exchanging information called "knowledge" requires negotiation of meaning between two different individuals: "Exchanging context-laden tacit knowledge requires a shift from viewing knowledge as a thing to be transferred to viewing its acquisition as a process of negotiating meaning among partners" (Rogers et al., 2013, p.4). And even after meaning has been negotiated, and biases have been acknowledged, how can we be sure that the same "knowledge" is shared? Ultimately, it is uncertain.

Education involves determining, organizing, transferring and advancing "knowledge" through the interactions between diverse individuals in order to ensure the collective success and growth of humanity. This does not always happen in a simple manner. At times all this happens "on the edge of chaos" (Morin 2008). Knowledge co-construction happens through a myriad of forces creating order and disorder, influencing interactions of meaning-making through individual perceptions and biases to arrive at an ultimately unquantifiable outcome. The teacher is not in control of this phenomenon. S/he just facilitates the process of exploration. The input will not always match the output of information, and this is as it should be in the essence of what education can be. It can be emergent, uncertain, and complex. In essence, it can be more than a simple passing on of knowledge and awareness. Education can be a means of creativity and innovation.

Education is a fascinatingly complex phenomenon. Individuals engage in interactions on a daily basis with no guarantee of a set outcome. Each individual struggles with the complexity of transmitting information through communication whether to pass on awareness and knowledge or by showing that they have acquired awareness and knowledge. In turn, they transform and advance "knowledge".

Educators must appreciate that they are the guardians of a specific society at any given place and time and that they are also responsible for the change that occurs over time to that society. Educators can be the creators of an emergent reality in concert with their students through educational interactions. They have been charged with the impossible: to maintain the status quo of an already disappearing past and to transmit awareness to future generations for needs that do not yet exist.

Society relies upon this complex feedback loop for progress and for the adaptability of the next generation for an uncertain future. This gives education import: it is through interactions between people in the present by using lessons from the past that we create a future that is emergent and reflects growth. In spite of this uncertainty and this struggle, education is a requirement for the continuance of society and of humanity.

What is the teacher's role?

If education is essentially interactional, based on meaning negotiated between two individuals or groups of individuals and how they relate that information back to the whole that they belong to, then the role and behaviors of each person involved in these interactions is truly important. Especially when we consider the end result of education as the creation of the future by moving meaning and ideas from the past forward. This question, "What is the role of the teacher?" is vital in understanding how educators must frame their world, their interactions and think complexly.

In his masters' thesis on Teaching as a Reflective Practice, SIT Graduate William Culver stated that:

> *A successful approach to teaching involves more than instructional methodologies and the communicating of facts – it also includes professional inquiry, self-study, synthesis, the search for hidden truths, encounters with personal fears and failures, motivation and invocation together with an emerging and enlarging sense of identity. As sentient and rational beings, people come to know by connecting, not disconnecting (Culver, 2012, p. 16).*

Similarly, Morin promoted the view that a social scientist/researcher and scholar should engage in inquiry that is framed and understood as part of their own lived personal experiences. He acknowledged that subjectivity was part of living, and that the façade of objectivity in scientific or sociological research was harmful to the knowledge that was gained (Montuori, 2013, p. 7-8). Thus, educators must make meaning of their own lived experiences by making connections to their students, their environment, their content and by passing these on or using them to achieve higher levels of engagement and organization. It is not coincidental that these days most disciplines elicit both emic and etic perspectives and strive to strike a balance between

quantitative and qualitative research, with an ever stronger shift toward explorations that are time and context bound.

As educators, we must be aware of ourselves, and frame our understanding of environments, the systems of education that we work in and our attitudes, and how we engage with others through and because of our perceptions, prejudices, and experiences. This practice puts us, as educators, fully into the realm of appreciating ourselves as individuals who constantly take part in a collective environment, and that the collective environment shapes us as we shape it. This is the deeper understanding that Edgar Morin suggests through his work on part and whole, one and multiple: "…it is impossible to understand the whole without understanding the part, and impossible to understand the part without understanding the whole" (Montuori, 2013, p.5).

Having a genuine and deep awareness of one's position in the world gives power and agency. One can see that actions matter, even when they occur on the micro level, they greatly affect the macro level. This empowers educators to action, to take responsibility for the part they play in educating the next generation. As Pennycook argues:

> *What we need to understand is that there is a complex interplay between classrooms and the outside world, or rather that classrooms are not so much a reflection of the outside world, but rather part of the outside world, and in fact play a role in how that outside world operates. From this perspective, the walls of classrooms become permeable, with social relations outside classrooms affecting what goes on inside, and social relations inside affecting what goes on outside…our classrooms are part of the real world (Pennycook 2000, p. 92).*

Educators are real people having interactions with other real people. They are not robotic, neutral nor objective. The pretense of objectivity is simply a way of refusing to acknowledge the reality that each individual is having subjective experiences in this world.

While people have the right and freedom to disillusionment, the argument against this pretense is that it is having negative impact on society as a whole. When children are overprotected and sheltered from encountering real people, and the real world, they are incapable of having healthy experiences later in their lives. Instead they continue to live lives of disillusionment. The pretense of objectivity also shelters the next generation from experiencing complexity and mindsets become set in disjunctive, reductionist tendencies.

What this suggests is not that educators should open up about every detail of their life with their students, but that they should question and reframe personally their interactions in order to create a sense of trust and authenticity in the classroom. This openness and frame of mind is meant to allow interactions to flow in an authentic way. Students will engage more with other humans, rather than a robotic "teacher" whose sole purpose is to "school" the student.

Within this frame of mind, one must also understand that teacher judgement, situational awareness, and professionalism will be expected. The ability to recognize differences among students, issues that may be plaguing them, time, place, and events that affect them is key to making an educator capable of exercising good judgement. Furthermore, considering oneself a professional and acting as such is also empowering. Professionalism implies a sense of power given to the individual. With that power, teachers are able to act with agency in ways that show character and good judgement. It is to the detriment of the entire system of education that teacher judgement is questioned, controlled and their power withdrawn.

Gert Biesta argues in his article "What is Education for?", that "treating students as customers; being accountable; and replacing subjective judgement with scientific evidence are undermining rather than enhancing opportunities for teacher professionalism" (Biesta 2015, p.

1). In his article he expounds on the three domains of educational purpose (qualification, socialisation, and subjectification) and states that,

> *This has a number of important implications for the design, enactment, and justification of education – implications that are first and foremost relevant for the work of the teacher. What it makes visible is the central and essential role of judgement in education (Biesta 2015, p. 78).*

Teachers make judgements that are the entirety of the educational experience of the students. They do this because they know their content, they know their students, they know the environment, the situation, the way that they interact with others, they have specific expectations, and they live in an interactional relationship with students every day. They must make good judgements every day simply to exist in the phenomenon of educational interaction. These judgements are always highly personal. To reduce this complexity of the teacher, their interactions within the I/thou/it triangle, and their judgements within those interactions and to attempt to control them is a disservice to them and to the students. It is also a rejection of the nature of education.

Educators with sound judgement, situational awareness, openness as a frame of mind, and an ability to think complexly must also become scholar/practitioners. For too long there has been a divide between educators who do research and promote theory and educators who develop good practices of methodology. Montuori identifies this problem in an article promoting transdisciplinarity:

> *Historically scholars have often not been aware of the complexities of practice and application. Conversely, practitioners have often not been informed by, or been able to assess, the vast realm of rich theoretical and empirical research (Montuori & Donnelly, 2016, p. 753-754).*

Transdisciplinarity is his answer to bridge this divide. Its goal is to tie the two realms together and “foster the development of scholar/practitioners who both understand the

complexities of the systems they study and the actual practices of creating change." (Montuori & Donnelly, 2016, p. 754)

Being a scholar-practitioner may seem daunting. However, it is possible with complex thought, appreciation for radical uncertainty, and with openness as a state of mind. Embracing critical complexity requires this state of mind as well as for a level of comfort with challenges and not solutions. When one is able to think outside of the box of teacher/student daily interactions, worksheets, tests, and grades, education becomes a world of possibilities.

One possibility that is often ignored is to communicate with students on a metacognitive level of educational discourse. The logical argument for this is that if students are to learn HOW to learn, we must address how learning happens. Entrusting students with more knowledge is not dangerous, even if there is uncertainty about how much will be learned. For example, students in language classes benefit from understanding the process through which their brain can acquire knowledge. They can identify the ways to learn, force learning, or allow transferal of knowledge. They can appreciate that they will not be able to fully receive every piece of information that may be input, nor will they be able to fully output it all. They should be taught to have an awareness of what educational interactions are like, what purpose they serve, what their studies may or can mean for them in their lives. They also should fully understand the role of teacher, and the role of student by embracing their own power and agency in their individual education and the qualification they seek, the socialisation they are part of, and the subjectification they would like to embody. These are conversations that should happen between a scholar/practitioner and a student. These conversations show openness, trust, and a belief that relationships matter in education.

Engaging in critical complexity

Having a complexity frame of reference to understand the nature and purpose of education, those involved in education, and the role of the teacher is the foundation for action in engagement with critical complexity. Ignoring this foundation is often the mistake of individuals who are overwhelmed with the complexity of the depth of engagement and who are unwilling or naïve about the necessity and urgency of changing their mindset from one of reductionism to one of complexity appreciation. It is also necessary to have certain tools and awareness in order to engage in critical complexity. These are essential in being able to act in a critical and complex way that reflects an engagement of both lived and learned complexity.

Why should educators engage in critical complexity?

What is the impetus to change one's mindset from one of reductionism to one of complexity? People essentially only change when there is a bifurcation point – wherein they are no longer comfortable with the reality of the past, and they choose to re-organize themselves, their perceptions, and their behaviors in order to move to a higher order of existence (Morin, 2008). This discomfort comes into being because of disequilibrium in a system. At this bifurcation point and because of disequilibrium, there exists a "moment of freedom". This freedom is the ability to choose a way forward. It is not the choice itself that is freedom (Osberg 2000, p. 157, 164).

Freedom is an idea that is all too often simplified. Freedom, philosophically defined as a course of action, is having the ability to choose one course of action over another. Freedom is not the choice, nor the solution. Freedom is being able to act in one way or another, or even to not act at all.

The moment of freedom when confronting disequilibrium and a bifurcation point, wherein a choice must be made, is also a moment of "care" under the terms defined by Osberg. The "ethics of care" can be related to the "ethics of responsibility for the future" and the "responsibility to take care of the future" (Osberg 2000, p. 158). What is further defined by Osberg is the framing of this responsibility in complexity theory terms. Thus, "taking care of the future" is a practice that is open-ended, radically uncertain, and a challenge not a solution to engage with education in a critically complex manner.

When considering this moment of freedom/care/responsibility from the point of view of the educator, one must remember that there is freedom to care, to take responsibility, to act, and

there is freedom to simply do none of these. When looking back at the question, "what is the impetus to change?", one can argue that if there is no impetus to change at a bifurcation point, educators have the freedom to choose inaction as a course of action. They can also choose not to embrace complexity theory in regards to education.

In the way that Osberg defines responsibility, it is clear that the choice of inaction as mentioned above is not an option. The definition of responsibility fundamentally changes the freedom that educators have to choose action or inaction. She defines responsibility in terms of power, using the work of Hans Jonas: "responsibility as the *obligation* to act in the interests of another…*over whom we have power*." (Osberg 2000, p. 161) Because educators fundamentally have power over their students, they are obligated and responsible to act in their interests.

Additionally she states, "For Jonas, responsibility for the future is an obligation or duty that has no terminus. It is responsibility for life itself "in its ever-new, always unprecedented productions, which no knowledge of essence can predict" (1984, p.126)" (Osberg 2000, p. 162). This encapsulates perfectly the complexity mindset regarding education. Education is life itself, if we choose to define it in terms of humanity and growth. Educators have an obligation for the future of life which potentially has no end and for the future which can never be predicted.

Osberg identifies this paradox:

> *We cannot know in advance what the future will be like then we also cannot know in advance (even in principle) what its "needs" will be. And if we cannot know what the needs of the future will be, then we cannot act in a way calculated to meet those needs (Osberg 2000, p. 162).*

This paradox frames education for educators as an impossible mission. They cannot know what they must transfer in the form of knowledge for the success of the future. They cannot know if

the means they take in the present will help the next generation to arrive at adaptability. It is only in the future that the actions of the past will be seen as successful or not.

For educators this paradox is a daily undertaking that is extremely relevant. Educators engage in teleology every day as they plan lessons and engage in backwards design by determining from the beginning what will be relevant at the end of the lesson. They try to ensure and predict not only what will be learned, but what will be relevant to the future. In many ways, educators are given power over students. They must act in the interests of their students and in the interest of their profession which impacts human life in very significant ways. Educators then are responsible for these impacts on the present and the future, and yet cannot predict what will be necessary for life to continue and thrive in an uncertain future. How then should they act and make decisions that are in essence political, irreversible, and deterministic of the future?

Osberg continues by challenging the reader not to attempt to control the future, which is a denial of its "radical futurity", by crafting a "shared vision" or a "compelling shared purpose" (Osberg 2000, p. 163). Any attempt to control the future is a reduction of complexity and a political act in the way that it determines paths that reflect the values of some and not all (Osberg 2000, p. 164-166). Rather she proposes a "sensitive and tentative experimentation with what is not yet possible" derived and inspired by Derrida's "experience and experiment of the possibility of the impossible" (Osberg 2000, p. 166-167).

In this viewpoint one is challenged again to embrace the fact that the future is incalculable. That one must neither attempt to control it, nor passively accept it, as neither is responsible nor shows an "ethics of care" for the future. Osberg proposes to use the "logic of emergence", which "guides in a way that is non-arbitrary, based on the rules of the past…by

using the rules of the past in an experimental way to create something radically new, something which is beyond rules, beyond what we can calculate as being possible" (Osberg 2000, p. 167). This logic of emergence is in essence tied to complexity theory.

Here there is space to acknowledge apathy and disillusionment, as well as extremism. Ignoring the requirement to respect the rules of the past and instead to believe in creating the impossible can lead to irresponsible actions. If education does not prepare future generations to live in the present and create an emergent future by using lessons from the past, then it is not respecting this "logic of emergence" nor is it showing "care" (Osberg, 2000, 167). Instead, students may be trapped in the past, or in a non-existent present reality that does not reflect the whole of the society that they live in. This has been well documented with some cases of home-schooling. This is also the case with examples of methodology that leave everything to chance and are not strategic in the way that they seek to pass on knowledge.

In the case of apathy and disillusionment, there are many people involved in the system of education who choose inaction. They choose to ignore their role, the power they have to engage, and thereby to cause change. It is their freedom to choose this course of non-action. However, by refusing to engage with the politics of education, they are also choosing to act in an irresponsible and unethical way. This is a political action. It allows power to be taken away from them and distributed elsewhere.

Making the choice to engage with the system in that moment of freedom, to recognize choice of action or inaction, and to proceed shows an ethical connection to "care" about society, about others, and to take responsibility to move forward in the survival of the human race through education. Paul Cilliers wrote in the book edited by Deborah Osberg, "we have to make

choices which cannot be reduced to calculation alone" (Osberg, 2010, p. 157). Osberg takes that one step forward by framing the idea of having "an affirmative orientation to the future". She supports this stance:

> *If we care about the future, it matters very much that we do the "right thing… it is important that we act in a way that will indeed positively influence the future, rather than that we act in a way that will have a negative effect or that we refrain from acting at all (Osberg, 2010, p. 157).*

In many complex ways, educators are future-makers. Choosing to have a positive influence on the future is an action that reflects power, agency, responsibility, and care.

In this sense educators are NOT free to choose inaction. If they choose inaction, they are not responding to their role as an educator. They are denying the depth of engagement existentially that an educator has within their profession. Yet action in a complex frame of reference is a "sensitive and tentative experimentation with what is not yet possible" (Osberg 2000, p. 166).

Educators have a relationship with the whole of humanity in the sense that they are bringing lessons from the past, to the present, in an attempt to prepare generations for the future. They are engaged in growth and change. They have power in this relationship over other people, as well as over the future. In any case of power, responsibility is vital. Educators must be responsible for their actions and interactions as they exercise power and agency in their profession. They have the ethical responsibility to consider all things in a complex way; to recognize that controlling things means exerting power over them, that choices have consequences that cannot be undone in time and space, that the future is open-ended and systems achieve higher levels of organization through emergentism.

Osberg closes with a call to “educational democracy” and an appreciation that “education can be a place of paradox, a place of experimentation, with the possibility of the impossible… education can be in principle inventionalistic” (Osberg 2000, p. 168). All things are possible with complex thinking, framing the past to learn from it, and learning to allow the future to manifest.

In summary, the argument for change and towards complex thought and mindsets reflects the importance of care and responsibility that educators have for their collective society and for the future. When educators understand the nature of education, and are aware of their involvement in it, they will be equipped with an awareness of their power, their potential agency, and the need to act responsibly. Without the necessary awareness, there can be no impetus to change.

How can one engage in critical complexity?

CRITIQUE

Critique is a word with multiple linguistic ties, including those to words such as critical, crisis, and criterion (Alhadeff-Jones 2000, p. 28). These words are heavy when referencing education at present. It is critical that education change, that it is considered as a crisis and that the right criteria are found for its change and for the judging of it.

Critique is a way of analyzing, reflecting, and considering and reconsidering certain aspects of oneself and the world in order to determine if they are functioning effectively and if they are serving both the individual and the community. Critique is an essential part of change, for without criticism there can be no impetus for change to occur. Michel Alhadeff-Jones has suggested that the critique that is currently prevalent in the educational domain is insufficient. It "does not provide a framework considering more systematically their conditions of emergence, their own limitations, as well as the antagonistic, complementary, and contradictory relationships, which connect them to one another" (Alhadeff-Jones 2000, p. 26).

Thus, critique in education does not embody complex thought and individual subjectivity in relation to proposed solutions for the collective, nor does it make connections to socio-cultural and historical developments in education and to the developments of the same critiques. In a previous chapter of the same book, Gert Biesta writes on "the politics of complexity reduction" and poses the question, "who is actually reducing complexity for whom and whose interests are at stake or being served by doing so?" (Biesta 2000, p. 7). This question requires the critique of education through complex thought and by framing value-judgements through subjectivity. It is important to remember that "using a language of values" and "using a language of power" are

"two sides of the same coin" and both "involve the exertion of power" (Biesta & Osberg 2000, p. 1).

One can see complex thought as essential to the critique of education as one must frame current critique in education through a lens of power dynamics between competing discourses as different parties attempt to control the future of education. In order to more complexly engage in critique one must understand how to think complexly, and how to create frameworks and habits of mind that allow for complex criticism. Alhadeff-Jones states,

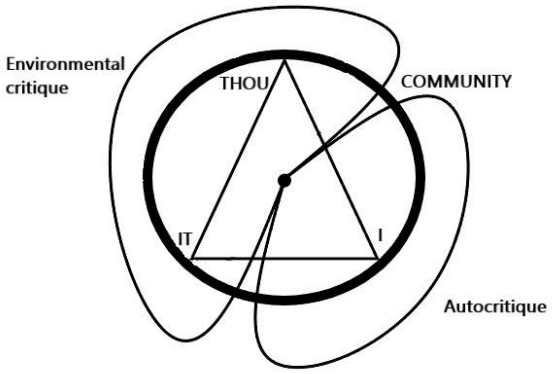
> *The simultaneous presence of disorder and order among heterogeneous representations of the idea of critique finally involves the recognition of some kind of organization allowing one to understand it as a complex idea (Alhadeff-Jones 2000, p. 29).*

The challenge is not to consider order and disorder in the complexity of critique as an "overwhelming phenomenon" (Alhadeff-Jones 2000, p. 29). Nor is the solution to begin dismantling the need for critique in education by isolating, reinterpreting, and comparing competing discourses about educational critique to serve the reputation of an institution or the ego of an academic. Not only is critique seen as a complex part of the realm of education, it is also a means through which education can be reformed and through which educators can engage with the system.

SELF ECO CRITIQUE

To engage with critical complexity requires autocritique through self-reflection. As Alhadeff-Jones clarifies "It requires the adoption of a specific state of mind and a way of being. Research about critique and complexity is always a learning process about the world and about oneself" (Alhadeff-Jones 2000, p. 35). This is a challenge to engage in "self-eco-critique" which is "an organized capacity emerging from the recursive loop involving both the critique of one's environment, as well as one's own self-critique" (Alhadeff-Jones 2000, p. 35).

Self -Eco-Critique



In this diagram on self-eco-critique, the individual finds themselves in the center point of the interactions of education. The individual in question can be the teacher or the learner. This person is surrounded by the triangle that represents the interactions of I/thou/it between teacher, student and content. The triangle is encircled by a sphere that represents the outside communities (real and virtual), which influence both the educational interactions, as well as each entity in the I/thou/it triangle singularly. This means that the teacher, the student and even the content is influenced by the community. As Pennycook states, "there is a complex interplay between classrooms and the outside world" (Pennycook 2000, p. 92). Finally the person at the center of the diagram is engaging in self-eco-critique represented by the feedback loops that interact with the community, the teacher/student(s), the content and oneself.

There is an environmental critique happening in this diagram of the subject matter, of the teacher or student (s), of the community(ies) and of the interactions between these elements and the individual and how they are interwoven. There is also an autocritique, or self-critique, happening in the diagram of the individual and their existence as both part of the community and the ways in which the community is in them. It is also a critique of oneself in relation to the other

parts of the triangle – the teacher or student(s) and the content and its effects of both on the individual. The center point is the essence of self-eco-critique which is a synthesis of all elements and how they are engaging and informing one another in harmony and in conflict inside of the individual.

This diagram is singular, meaning that it is taken from the point of view of the individual. It does not represent the fact that every individual is going through this process in each community, and that as they are going through these processes, they are creating the emergent reality that we live in now and will live in the future. Additionally these interactions are happening in relation to other communities, and in relation to the world; which would include other content areas and teachers. The entirety of these interactions is then creating the complexity of the world in an emergent way.

Engaging in self-eco-critique is a reflective practice that allows for the critique of education and educational practice through the use of complex thought. Self-eco-critique invites one to revisit, enrich, contest, and conceive of notions about oneself, knowledge, social constructs and all their elements. Self-eco-critique is a truly reflective practice of inquiry wherein one must have an openness and a willingness to critique oneself. It requires a state of curiosity that is not afraid of uncertainty and does not need to look at others through a reductionist lens in order to better understand oneself and the environment. This practice cannot be successfully accomplished if one is motivated to promote one's ego through the critique of education and others.

Self-eco-critique allows a person to appreciate their individual existence in relation to the whole and their existence with the whole as well as the existence of the whole within them, and

the ways that they create the whole. It is a strategy for understanding the world that can be passed on in order to allow new generations an awareness and ability to remain flexible and adaptable to the world as it changes. It is also a method for reflection that can lead to individual and systemic change. For systemic change to happen, individuals must willingly engage in self-eco-critique and take on the responsibility and care to enact change internally which will lead to external and systemic change.

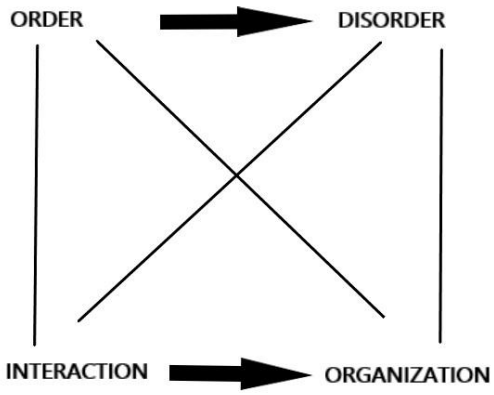
How can education engage in critical complexity?

SELF ECO RE-ORGANIZATION

Self-eco-re-organization is a framework for processing education within a complexity frame of reference. It is also a means of reflection that can be applied to both the singular and the plural, and can be used to understand the interactions of the external and the internal. Self-eco-re-organization is the way in which an organization (singular or collective) processes interactions that cause order and/or disorder and synthesizes these challenges to achieve higher levels of organization when and if necessary. There can be a generative creation of organization through the relationship between order and disorder in educational interactions and self-eco-re-organization is a way of perceiving this possibility (Morin 2008).

Self-eco-re-organization was developed by Edgar Morin:

> *Order, disorder, and organization have a complex relationship through interaction (Morin, 1981). Organization without disorder leads to a sterile, homogenous system where no change and innovation is possible. Complete disorder without order precludes organization. Only with the interaction of order and disorder, is an organization possible that remains open to change, growth, and possibilities (Morin, 2007b) (Morin, 2008, p. xxxiii).*



It is important to preface the discussion of order and disorder with an awareness of the relationship that these have been given in Western thought: disorder is a destructive force and order is the optimal state of being. However Morin, and the influences of the sciences of chaos and complexity, have challenged this point of view (Morin 2008). Montuori clarified this in the foreword to Morin's book, *On Complexity*:

> *As Taylor (2001, p. 121) writes, "disorder does not simply destroy order, structure, and organization, but is also a condition of their formation and reformation." The interaction of order and disorder can be generative of new forms of organization, and any order is the result of an ongoing process, not of pre-established forms (Morin, 2008, p. xxxiv).*

Thus, self-eco-re-organization is constantly happening. The forms of organization in the future are reflective of the stimuli to the system, and the forms of organization in the present are representative of the stimuli of the past. There is no absolute correctness in terms of organization. It is entirely situationally and temporally influenced.

In the term self-eco-re-organization there are several prefixes to the idea of organization. Self-organization "involves the emergence of order out of spontaneous interactions in response to disorder" or "a spontaneous emergence of collaborate behavior among elements in a system" (Morin, 2008, p. xxxv). When the prefix eco- is added to this it is to clarify that "a system does not merely organize itself, independently of its environment. The environment is in the system, which is in the environment" (Morin, 2008, p. xxxv). Thus, a system organizes itself in response to its environment and the interactions of order and disorder within it. Additionally, the system does not simply organize once, it continually re-organizes itself. It is a constant reflective process of a system to self-eco-re-organize in order to adapt to constant stimulus from the environment. Morin states, "Every system, whether individual or a corporation, is also an organization. But an organization is not static. And organization is always re-organization. Organization therefore is

always a process, not something that is fixed and once and for all" (Morin, 2008, p. xxxvi). This point of view is reflective of complex adaptive systems, in any domain that they exist.

As mentioned earlier systems seek higher forms of being when they are faced with a discomforting sense of disequilibrium. As systems adapt to their environments, they consider their interactions, order and disorder, and the (re)organization of the system. This tetrad is a way to see the complexity of these phenomena acting on and influencing one another. It can be used to explain natural phenomenon in the physical world for complex adaptive systems, as well as be used as a way of seeing how individuals organize themselves in reaction to their environment(s).

Revisiting oneself in relation to one's environment is the entirety of the challenge of self-eco-re-organization as proposed by Edgar Morin. This is a way to reflexively reflect on oneself, one's actions, order and disorder, organization and chaos and the interactions of the individual with the environment in order to achieve new levels and states of being in the world.

It is significant to understand that the process of organization does not necessarily lead to new levels and states of being in the world. In fact systems can fail to achieve self-eco-re-organization:

> *The order out of disorder that emerges in an open systems' interaction with its environment is subject to fluctuation. When certain levels of fluctuation are created by increasing complexity, a critical or bifurcation point is reached. At that point the system can move in any one of several directions until a new and more complex order may be established after a period of turbulence. If a higher order of organization does not emerge, the system returns to a previous, lower level of organization (Morin, 2008, p. xxxv).*

Thus, systems can appear to fail. They must sink to lower levels of organization until they are able to build the momentum and creatively change to meet the need for innovative organization caused by the effects of order and disorder through complex interactions.

The stress on movement to a higher level was coined by Morin's term "organizACTION" (Morin, 2008, p. xxxvi). If the organization is unable to move from a lower form of organization to a higher form of organization in response to the challenges posed by disequilibrium, then a system will appear to fail by reducing itself to lower forms of organization. It is through action into a new state, a creative RE-organization of itself that a system adapts to its environment and appears to succeed.

This is true for personal growth as an individual human, just as it is true for the entirety of humanity in response to unforeseen challenges that may arise or that we may experience. It is through education that we become adaptable. Education has been the response of humanity to re-organize and to successfully survive and grow.

An organization (an individual or a system) self-eco-re-organizes in reflection of its past and in reaction to unforeseen challenges. The ability to move from one state of organization in the past, to a new state of existence is to be able to creatively emerge into the future. Unexpected events and uncertainty are sources of change and creativity when they can be processed in a way that manifests never before seen organization. This is the necessary purpose and nature of education in our unprecedented present. Humanity is currently challenged to deal with ambiguity and contingency in this new *interregnum*. Self-Eco-Re-Organization must be the response: to emerge into new levels of order through the collaborative interactions of elements in a system in reaction to the environment and through an understanding of the past, an appreciation for uncertainty, through the process of finding creative and flexible means to adapt continuously.

Collaborative self-organization of educators

Educators themselves must both control and promote their own ego in their profession. By controlling one's ego, educators engage in genuine interactions with students. They recognize that passing on awareness is not for their own benefit, to make them important, feel smart, or get paid more, and that in fact they do not control knowledge. In fact, the essence of education is selflessness. It is to make possible the passing on of knowledge, awareness, and frames of mind to new generations to ensure the success of the future. Keeping this in mind every day provides perspective and the potential for control of ego and the proper exercise of power through responsibility.

Educators must promote themselves if they are to challenge oversimplification, reductionism, and withdrawal of power from the profession. In order to positively promote the profession, teachers must become aware, they must act intentionally, with responsibility and agency. By acting within their power, they will obtain the ability to make a bigger difference in society as a whole.

Barron's "articulation of ego-strength as flexibility and adaptability for self-re-creation (Barron 1953b)" is worth taking note of (Montuori & Donnelly, 2016, p. 751). In order for educators to promote their ego up the spectrum of power dynamics (to act in their agency and gain power to work for positive change), they must have strong enough egos that are flexible and adaptable and can work through processes of self-re-creation, such as those laid out by Alhadeff-Jones (self-eco-critique) and Morin (self-eco-re-organization). The challenge to ego-strength in this area is perceived powerlessness. Lack of knowledge and awareness, financial troubles, contracts, lack of union or community strength among educators are all ways in which the egos of educators are weakened. Only when teachers have strong enough egos to act with agency and

to reflect on their practice and their role in education will they be able to engage in processes of inquiry, critique, and re-organization.

While this idea creates pause in the affirmative orientation towards the future that teachers need to have, the awareness of education as a complex adaptive system provides further insights into emergent qualities that may assist in creating positive reform. Education is a complex adaptive system, "characterized by self-organization, emergence, interdependence, interconnectedness, and uncertainty" (Montuori & Donnelly, 2016, p. 749). Montuori goes on to explain, "The phenomena of self-organization and emergence, central to CAS, refer to the processes through which higher-level order emerges bottom-up from the interactions of agent, rather than top-down" (Montuori & Donnelly, 2016, p. 749). This process is relevant to social movements, and can be exactly what happens in education in order to enact change.

If educators are able to let go of their perceived powerlessness, to self-organize and promote themselves through bottom-up interactions among agents, then they will be able to create a new emergent reality in education. Thus it is powerfully true to say that if educators want change, they must promote themselves, they must self-organize, they must connect and depend on one another, they must learn and grow and assert their power. Although the future is uncertain, the phenomenon of emergence is one that is sure.

CONCLUSION

The need for education reform, embracing complex thought and an engagement in critical complexity is urgent. It is critical. The bifurcation point is evident. We will not successfully adapt to the new age that is emerging if education does not rise to meet the challenge. Remaining in a lower state of organization, wherein apathetic educators choose inaction is no longer a viable choice.

Complexity theorists are well aware of the new era, and the disequilibrium that now exists. Montuori summarizes this challenge succinctly:

> *Whereas in previous ages life was arguably relatively simple, predictable, and unambiguous, we are now faced with a different world. But are we equipped to deal with it? Increasingly, the answer is no (Morin, 2008, p. xxxvii).*

How and why are we not equipped to deal with it?

Simply, education is not reflecting the new impetus to change nor the ability to respond complexly. At present it is quite challenging to expect people to be able to engage in complex thought. Montuori again states:

> *But it's clear that our educational systems have not prepared us for this condition. And what's more, it's far from clear that there is a sense of urgency about understanding our planetary context. We are simply not prepared for the full implications of a global, interconnected, uncertain world. In fact, it's increasingly obvious that it's painfully difficult to even figure out how to being to think about this world we're living in. (Morin, 2008, p. xxxvii)*

This paints a dire picture of the world that exists today: as a whole people are not aware of complex thought. They do not know they are living in reductionist mindsets. They do not know how to embrace complexity. Reductionist and simplistic mindsets in education have not led to the awareness that allow teachers and students to make connections between the part and the whole. Neither are the connections between past, and present and potential future being

made. Education must drastically change. It must self-eco-re-organize. Who better to engage in this process, than educators themselves?

When educators engage in transformative learning and learn to live in complexity we will be able to individually, and eventually, collectively reform and re-organize the system of education. It is through the part that the whole is created, and through the whole that the part exists. Educators must embrace new mindsets of uncertainty, and have faith in emergence. We must engage in the processes of self-eco-critique and self-eco-re-organization. We must form teams to commit to organizACTION. The understanding of complex thought and the awareness of urgency for critical complexity is not enough. Educators must have an affirmative orientation towards the future, acting responsibly and showing care. We need to engage in a "duality of knowing and being" (Rogers et al., 2013, p.1). We must learn to live in the intersection of internalized and transferred complexity by becoming scholar-practitioners and living examples of complex adaptive systems. Finally it is essential that there exists "a sense that we, as educators, can do something" (Pennycook, 2000, p. 96). We must believe in our profession, in our own growth and in the growth of the educational system. We must continue to believe in the "pedagogy of possibility" (Rogers 1992). Educators have agency, and we must live in the power that we have to act and be a positive influence on the future.

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